Impacts of migration on health and well-being in later life in China

How Migration Relate to Health and Well-being in Later Life in China? Evidence from the China Health and Retirement Longitudinal Study (CHARLS)

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Abstract

Unprecedented internal migration to urban areas has happened in China over the last few decades. While, we know that migration has a bidirectional relationship with health, this relationship has only been studied to a limited extent in China. In particular, the exiting literature has neglected the effects of migration on health and well-being in later life, instead focusing on the relationship between these outcomes over the short term, and also have only focused on temporary rural-to-urban migrants with a rural hukou rather than the broader range of internal migration flows. The hukou system, also known as the Chinese household system, an institutional feature with the power to restrict population mobility and access to local welfare resources.

Using an inter-disciplinary approach, drawing on literature from economics, epidemiology and sociology, this paper conceptualises and examines the association between different forms of internal migration and their relationship with later-life health and well-being in China. It then attempts to draw conclusions on likely mechanisms through which migration affects health and well-being, including taking account of the selective nature of migration. To do this, we use the China Health and Retirement Longitudinal Study (CHARLS), a nationally representative and multi-disciplinary dataset that examines the circumstances of the Chinese population aged over 45 years old.

The results show that there are strong associations between migration status and later life health and well-being in China, with migrants to or within urban areas report the greatest health. Even after controlling for the selective nature of migration and other post-migration factors, there is still an unexplained, positive and statistically significant migration effect on depression scores associated with rural-to-urban migrants who have a rural hukou. In addition, there are no differences between rural-to-rural migrants and rural non-migrants across all models. In terms of relevant causal processes, selection of migrants seems to be particularly important in explaining the health and mental health differences between non-migrants and migrants to or within urban areas. Current socioeconomic circumstances and post-migration adaptation also explain some health differences between migrant groups and non-migrants.

Keywords Internal migration, rural-to-urban migration, later-life well-being, China

Introduction

Over the past several decades, the urban population of China has dramatically increased from 17.9% in 1978 to 51.3% in 2011 (NBS, 2012a). Internal migration to urban areas account for a large part of this growth (Chen and Chen, 2015). According to the sixth Chinese census, it is estimated there are 221 million rural-to-urban migrants in 2010 in China (NBS, 2012b). The latest figure from the National Bureau of Statistics of China estimates that there are around 282 million rural-to-urban migrants in China (NBS, 2017). This trend is expected to continue to increase in China (Yang et al., 2018). The sheer size of this migration makes it the largest migration in human history (Liang, 2016). Internal migration is a particularly important public health topic in China, not only because this process has health consequences on migrants and receiving communities, but also because it has health impacts on the family members of migrants and on sending communities (Hu et al., 2008, Li and Rose, 2017, Liang, 2016, Song, 2017, Chen et al., 2015, Lu et al., 2012).

To understand internal migration in China, it is also important to know the hukou system. The hukou system in China, also known as the household registration system, is a unique institutional feature of migration in China. It is loosely similar to an internal passport system that restricts rural migrants' mobility and is linked to access to local welfare and resources (Zhang, 2010, Vendryes, 2011). There are two main types of hukou, an agricultural type and a non-agricultural type; this classification is based on the rural/urban classification of a person's birthplace(Chan and Zhang, 1999). Generally, it is difficult to change one's hukou types (Zhang and Treiman, 2013, Wu and Treiman, 2004). It is argued that the hukou system is a major contributor to rural urban inequality in China as it limits the access of rural population to resources and public services at urban areas, such as social security (Liu, 2005, Xu et al., 2011, Cheng et al., 2014).

The most notable relationship between immigration (migration between countries) and health in the literature is the healthy migrant phenomenon, which refers to the evidence that first-generations of immigrants often have lower mortality and morbidity than native population (Singh and Siahpush, 2001, Razum et al., 2000, McDonald and Kennedy, 2004). This might be due to the highly selective nature of migration, i.e. the healthier is more likely to be able to migrate. Studies on the relationship between internal migration and health in many countries find mixed results (Saarela and Finnas, 2008, Ginsburg et al., 2018, Anglewicz et al., 2017). For instance, a study in South India finds internal labour migration can lead to better, worse or no change in health among migrant workers (Dodd et al., 2017). The existing literature on internal migration and health and well-being in China has mainly focused on the following three areas; infectious diseases such as tuberculosis, maternal health, and occupational disease and injuries (Hu et al., 2008). In addition, studies of migration in China have mainly focused on one type of migration, temporary rural-to-urban migration (Chen, 2011). These studies have mainly focused on the younger migrants in China. The existing literature on the relationship between internal migration and health and mental health in China is also inconclusive, in part because of the selective nature of migration and limited data on migrants (Li and Rose, 2017, Mou et al., 2013). For instance, using a sample of rural-to-urban migrants from two major cities in China, Li et al. (2006a) find that temporary rural-to-urban migration is associated with relatively poor health status and depressive symptoms. Studying a sample of migrant factory workers in Shenzhen, Mou et al. (2011) find a high prevalence of clinically relevant depressive symptoms. While in contrast, Chen (2011) uses a household survey from Beijing, and finds some support for the healthy migrant phenomenon in terms of health status, but not for psychological distress. Using the China Labor-force Dynamic Survey, Zhang et al. (2015) find that migrant population has better physical health status than rural residents, but not significantly better physical health than urban residents. Using a migrant sample collected in

Guangzhou city, Li et al. (2014) find migrant workers have a moderate but significant advantage in mental wellbeing compared to urban residents. Using a panel dataset, Song and Sun (2016) attempts to address the selection of migration by combining propensity-score matching and the difference-in-difference model, they find the effect of short-term migration on self-reported health is significantly positive, but insignificant effect for longer-term migration on health. Furthermore, there is a lack of understanding of why migration might be related to health and well-being in later-life in China.

To address these gaps in the literature, this paper explores how a range of types of internal migration relate to late-life health and well-being in China. First, we will propose an inter-disciplinary theoretical framework drawn from epidemiology, economics and sociology to explain links between migration and later-life health and well-being in China. Then, using a nationally representative dataset, the China Health and Retirement and Longitudinal Study (CHARLS), this paper will explore migration between and within rural and urban areas in China. This is because of existing inequalities between rural and urban areas in China (Knight and Song, 1999), and migration is partially driven by inequality in development (Koser, 2007). Particularly, this study will study the following types of migration; rural-to-rural, rural-to-urban with a rural hukou, rural-to-urban with an urban hukou and urban-to-urban migrants. Furthermore, we will attempt to address selective nature of migration in our analyses. This paper will test the following hypotheses. Hypothesis 1, the selective nature of migration will explain some differences in health differences between migrant and non-migrant groups. Hypothesis 2, current socioeconomic circumstances will also explain later-life differences in health and well-being between migrants and non-migrants. Further, we expect different associations according to different types of migration in both hypothesis 1 and 2. Hypothesis

3, factors related to post-migration adaptation such as social network and social integration will also be important to migrants' later-life health and well-being.

Literature Review

Internal migrants may benefit from positive health effects of migration such as access to better health care in urban areas, while experience negative effects such as stress related to acculturation (Lin et al., 2016). It is possible that there are time differences between these positive and negative health effects of migration (Salazar and Hu, 2016). Thus, we adapt a life course perspective to understand the impact of migration on health in later life. The life course perspective on health states that people's health status is a result of the accumulation of past social advantages and disadvantages throughout life (Ben-Shlomo and Kuh, 2002). To explain our theoretical framework, we group the mechanism of impacts of migration on health and well-being according to three themes; pre-migration experience, selection processes and post-migration experience. Important life events prior to migration may have important effects on later-life health after migration. There is a large body of evidence demonstrating the links between poor material and psychosocial conditions in childhood and poorer health and well-being in later life (Marmot and Wilkinson, 2005, Barker, 1995). In the context of internal migration in China, there is a large literature on inequalities in terms of socioeconomic conditions between rural and urban areas in China (Whyte, 2010). For example, compared with urban areas, rural areas often have low education levels, poor sanitation and poor healthcare (Knight and Song, 1999). Dramatic life events prior to migration could also have lasting impacts on health in later life, for example, the experience of the Great Famine in China (1959-1961). Chen and Zhou (2007) find the experience of the great famine causes severe health and economic consequences for the survivors, particularly for those who have experienced the famine during childhood. From another perspective, by escaping from these risk factors in rural

areas through rural-to-urban migration, migrants might have a better health outcome in later life compared with the rural non-migrants.

One possible explanation for the heathy migrant phenomenon is the healthy migrant effect, which is the persistent evidence that those who are healthier are more likely to migrate – a selection effect. Studies have found evidence to support this hypothesis in many different countries and also in the context of internal migration (Swerdlow, 1991, Chen, 2011, Riosmena et al., 2017, Tong and Piotrowski, 2012). Another notable migratory hypothesis that explains the paradox of immigrant's health advantage is the salmon bias hypothesis (Pablos-Méndez, 1994), which states that unhealthy immigrants tend to return home to die. Although empirical testing of this hypothesis is difficult, because data in destination countries does not capture of the outcomes for migrants who return, there are some empirical studies in the US, the UK and China that support this hypothesis (Wallace and Kulu, 2018, Lu and Qin, 2014, Turra and Elo, 2008). Zhang et al. (2015) find that the physical health of returned population is worse than the migrant population. Furthermore, not only is migration selective in relation to health, but studies from the US find that migrants are often better educated and have higher earnings than non-migrants (Gabriel and Schmitz, 1995, Bailey, 1993).

After migration, rural-to-urban migrants in China often have better socioeconomic status compared to rural natives and worse socioeconomic status compared with urban natives (Hu et al., 2008, Mou et al., 2015, Qiu et al., 2011b). More specifically, these migrants are often more likely to be in lower paid occupations, such as manufacturing and construction (Liang, 2016). These jobs have a higher risk of exposure to harmful substances (Wang et al., 2016). Rural-to-urban migrants in these jobs have lower incomes, no social benefits, work very long hours and

have very basic living conditions, e.g., living in a shared dormitory (Hesketh et al., 2008, Wen et al., 2017). Furthermore, studies have found these disadvantages in socioeconomic circumstances are related to rural migrants' self-rated health and mental health (Li et al., 2017, Qiu et al., 2011a, Zhong et al., 2015).

There are many theories that seek to explain post-migration cultural and social challenges on mental health, e.g. cultural shock theory (Oberg, 1960), cultural change theory (Hallowell, 1942), social isolation theory (Weinberg, 1966, Jaco, 1954), the theory of goal-striving stress (Parker et al., 1969). For individuals, acculturation is a process of culture change and adaption or maladaptation that stem from contact with culturally different people, groups and social influences (Gibson, 2001). The study of migration, acculturation and mental health has had a long history, further discussions and details of concepts of acculturation, can be found in Schwartz et al., (2010). In the Chinese internal migration context, although the differences in culture and languages might be relatively smaller compared with international migration, rural-to-urban migrants still experience various forms of acculturative stress and stigma related stress that affect the health and well-being of migrants (Zhong et al., 2016, Wang et al., 2010, Lin et al., 2016). Studying a sample of migrants from Chengdu, Qiu et al. (2011a) argue that it is more appropriate to use city adaptation rather than acculturation to study the impact of migration on the mental health of internal migrants. By using a question on how migrants have adapted to life in Chengdu, they find they find that city adaptation is positively related to mental health, and city adaptation is associated with length of residence in the city, job satisfaction and the level of social support received in the city. In addition, the presence of social connections in destination communities are found to be good for health and well-being of migrants (Cheung, 2014, Mao and Zhao, 2012).

This literature review provides a theoretical framework to explain how migration relates to health and well-being in later life in China. This framework proposes that internal migration is associated with later-life health through selection, current socioeconomic status, factors related to post-migration adaptation, such as acculturation and social connection. Thus, these factors may have consequences for health and well-being in later life.

Methods

This paper uses the China Health and Retirement Longitudinal Study (CHARLS), a nationally representative, multi-disciplinary and public dataset, that aims to capture the health and well-being of the Chinese population aged 45 and over (Zhao et al., 2014)**.** The nature of CHARLS is multi-disciplinary; it contains detailed information of respondents' social, economic and health conditions. Further details on the sample are provided elsewhere (Zhao et al., 2013). This paper uses the CHARLS national baseline survey, which was conducted between June 2011 and March 2012. The national baseline survey comprises information on about 17,000 individuals and 10,000 households. The reasons for choosing the CHARLS baseline survey in this study are: first, the detailed data on individuals' socioeconomic and health circumstances and some information on individuals' migration history provide a good opportunity to explore health and wider types of migration in China; second, the CHARLS dataset provides opportunities to study older migrants and, consequently, the long-run effects of migration on health and well-being as the effects of migration on health may take time to develop (Tong et al., 2018).

Classifying migrants is problematic, because the definition of migrants is not standardised in the literature and is sometimes unclear (Koser, 2007). In context of internal migration studies in China, a migrant is typically defined as: someone who comes from rural areas and works in an urban area, this person does not have an urban hukou, and this person is an adult and not a student; an example, see Qiu et al.,(2011a). Clearly, then, the typical definition of migrants in China only apply to one type of migration in China, temporary rural-to-urban migration, i.e., rural-to-urban migrants who have a rural hukou.

To explore wider internal migration processes in China, this paper classifies migrants according to any experience of geographical mobility. The respondents in CHARLS were asked 'where were you born?' The answer to this question has five options to choose from, 'this village', 'neighbourhood in this county or city', 'another county or city in this province', 'another province' and 'abroad'. Using this information, a migrant here is defined as a person whose current place of residence is different from his or her birthplace and not in the surrounding town or city of his or her birthplace. In defining migration, we have excluded movements within the same neighbourhood and we have included other movements within the same region. Our definition of migrants is limited to those who were born and still were living in China. Unlike the definition of the temporary rural-to-urban migration in China, this definition of migrants will allow us to explore migration between and within rural and urban areas in China, so migrants can be classified into rural-to-rural, rural-to-urban, urban-to-rural and urban-to-urban migrants. Because of data limitations, this framework cannot address origin and destination contexts beyond whether they are rural or urban. The CHARLS uses the classification of an urban area from the National Bureau of Statistics in China, which states a community is urban if it is located in a city, suburb of a city, a town, or other special areas, where non-farming employment constitutes at least 70% of the work force. Also, it is common

for migration to be treated as a dichotomous outcome, i.e. whether the person migrated or not. But this is problematic, as this ignores the fact that some, but not all, migrants become permanent residents at their destination. Using their hukou information, we are able to separate out permanent rural-to-urban migrants from temporary rural-to-urban migrants. Thus, we further divide rural-to-urban migrants into rural-to-urban migrants who have a rural hukou and rural-to-urban migrants who have an urban hukou. In addition to the 'settled' status and increased access to welfare that such a change in hukou represents, the latter category may also represent a more skilled type of rural-to-urban migrants, as they have managed to obtain an urban hukou.

In order to investigate the association between migration and health and well-being in China, the literature suggests that it is very important to address selection processes. To deal with them: using the CHARLS, firstly, we exclude all return migrants from the sample of migrants to address the selection of return migrants in order to address salmon bias (Pablos-Méndez, 1994, Lu and Qin, 2014). We exclude return migrants also to deal with limitations in the data on the reasons and timing for return migration. Return migrants are defined as those who have a migration experience of more than six months outside their birthplaces, but at interview they reside in their birthplaces. Secondly, we deal with the selection of migrants by controlling for pre-migration markers of selection, e.g., recalled youth health at the age of 15; but to do this, we need to exclude early-life migrants (the age at migration is younger than 16). The age at migration is calculated based on age of respondents, the year of interview and the timing of the initial migration in the survey. Unfortunately, due to data limitations, we do not have very detailed migration history. We do not know places where they had been to in-between the age of 16 and the date of the survey.

Based on these descriptions, this paper studies the following six groups of people: rural non-migrants, rural-to-rural migrants, rural-to-urban migrants with a rural hukou, rural-to-urban migrants with an urban hukou, urban non-migrants and urban-to-urban migrants. We do not include urban-to-rural migrants in our analyses, because there are very few people in this group. Non-migrants are defined as people whose current places of residence are the same or in the neighbourhood of their birthplaces, and they have never had any migration experience that is longer than six months. Non-migrants at rural and urban areas have rural and urban hukous respectively. In addition, we have truncated the sample at 80 to avoid concerns of acute selective mortality; about 3% of the CHARLS sample are over this age.

This paper looks at broad measures of health and well-being. The outcome variables are self-assessed general health status (five categories) and the Center for Epidemiologic Studies Depression Scale (CES-D)-10 items measure of depression symptoms (Radloff, 1977, Andresen et al., 1994). The CES-D scale also has been validated in the Chinese population(Boey, 1999, Cheng and Chan, 2005). Depression scores are calculated based on the CES-D-10 items that includes10 questions. Each question has a choice of four and each choice is assigned a score from 0 to 3. Thus, depression scores have a range of 0 to 30, with a mean of 8.65 and a standard deviation of 6.44. Self-assessed general health status is analysed with ordered logistic regressions and odds ratios are presented. Depression score is analysed with the ordinary least squares (OLS) regression. Lower values of these variables indicate better health. As the ordered logistic regression requires an assumption of proportional odds, multinomial logistic regressions and OLS regressions were used to check the robustness of the results for self-assessed health status.

This paper uses an empirical model that builds on the literature discussed earlier. In this model, we control for demographic, pre-migration early-life selective factors, and post-migration socioeconomic factors. We also include factors that are related to acculturation/city adaptation. Demographic factors include age, gender and marital status. Pre-migration early-life selective factors include youth health, education and first job. To measure youth health, this model uses recalled self-assessed youth health (five categories) at the age of 15. This measure may suffer from recall bias that arises from eliciting historical information from respondents, and recall bias is common in epidemiological studies (Raphael, 1987, Coughlin, 1990). To address potential recall bias in the self-recalled youth health, we use lower leg length (knee height), an objective measure to check for this. Studies have shown that leg length is a good indicator for childhood socioeconomic circumstances (Wadsworth et al., 2002, Webb et al., 2008). For socioeconomic factors, this model includes measures of current job status, annualised expenditure, households' consumer durables and house ownership. Level of acculturation or city adaptation is represented by time since migration to the place of destination and by participation in local social activities. Participation in the local social activity here is an indicator for levels of acculturation at the place of destination as it may capture some level of social integration and presence of a social network (Hou et al., 2017). Additionally, this model also controls for levels of familial support measured by how often respondents see their children and behavioural factors that include smoking and drinking behaviours as these may also relate to health and well-being in later life (Lam and Johnston, 2015, Mons et al., 2015, Liu, 2014, Hou et al., 2018).

To address hypothesis 1, we include a model that controls for early-life selective factors. Hypothesis 2 is tested by including individual socioeconomic factors. Hypothesis 3 is tested by including the acculturation indicator and the length of migration. Finally, we also include a

model that additionally control for familial support and behavioural factors. In addition, to check for collinearity, we also present a parsimonious model adjacent to the full model, which only includes statistically significant factors in the full model. We use a nested model building structure and a progression of regressions; gradually adding in each cluster of factors. To account for potential heteroscedasticity, robust standard errors are used in all regressions. Individual sampling weights were adjusted for in these analyses. Analyses were conducted using STATA 14 (StataCorp, College Station, TX, USA).

Results and discussion

Descriptive statistics

Table 1 shows the variable distribution sorted by migration status. In this table, all types of migrants show better averages of early-life selective factors such as youth health and education compared with non-migrants, except for rural-to-rural migrants. For example, 36.34% of rural non-migrants have no formal education. This number for rural-to-urban migrants with a rural hukou is 24.50%, is 14.75% for rural-to-urban migrants with an urban hukou, and is 40.25% for rural-to-rural migrants. In urban areas, 9.86% of urban non-migrants have no formal education, this compares with 7.12% of urban-to-urban migrants.

For current socioeconomic factors, migrants to urban areas or within urban areas have higher averages of annualised spending and household durable wealth compared with non-migrants. The average of estimated household durables wealth is 6,470 yuan for rural non-migrants, is 4,610 yuan for rural-to-rural migrants, is 10,740 yuan for rural-to-urban migrants with a rural hukou and is 14,740 yuan for rural-to-urban migrants with an urban hukou. This number is 11,460 yuan for urban non-migrants and is 22,740 for urban-to-urban migrants. Nevertheless,

non-migrants on average are more likely to fully own a house compared with migrants. For current job status, compared with rural non-migrants, higher proportions of both rural-to-urban migrants are in the not working group. 20% of rural-to-urban migrants with a rural hukou are at retirement age and receiving no public pension, this compares with 11.82% of rural-to-urban migrants with an urban hukou and 11.7% of rural non-migrants. This shows that the hukou status is strongly related to the access to a public pension in China. As these socioeconomic factors may affect health differently, we might expect different movements in the coefficients of the treatment variable after adjusting for socioeconomic factors.

In addition, migrants are slightly more socially active on average compared with non-migrant groups except for rural-to-urban migrants with a rural hukou, as a lower proportion of people in these migrant groups do not participate any type of social activity compared with non-migrants. In terms of smoking and drinking behaviours, fewer migrants currently smoke or drink alcohol compared with non-migrant groups , except for urban-to-urban migrants.

Table 1 Variable Distribution and Migration Status

Variables list	Rural non-migrants	Rural-to-rural	Rural-to-urban, with rural hukou	Rural-to-urban, with urban hukou	Urban non-migrants	Urban-to-urban	Sample Sizes
Health status (%)							
Excellent and very good	6.38%	5.33%	12.24%	9.22%	9.16%	10.71%	861
Good	15.03%	13.14%	16.91%	17%	18.87%	20.36%	1,896
Fair	43.94%	43.69%	43.44%	49.01%	50.84%	52.50%	5,442
Poor	31.37%	33.57%	25.36%	23.33%	19.36%	15%	5,408
Very poor	3.29%	4.26%	2.04%	1.45%	1.77%	1.43%	348
Depression scores	9.25	10.40	8.43	6.54	6.71	6.03	11,014
Age	59.34	58.88	57.47	64.87	57.64	64.11	12,006
Male (%)	47%	22%	34%	46%	46%	40%	12,020
Marital status (%)							
Married with spouse present	79.81%	80.32%	76.79%	80.94%	84.45%	78.80%	9,686
Married not living with spouse temporarily	6.37%	7.45%	10.03%	5.04%	3.80%	1.77%	712
Separated, divorced, widowed and never married	13.82%	12.23%	13.18%	14.03%	11.75%	19.43%	1,625
Recalled youth health (%)							
Excellent	8.62%	9.58%	10.64%	11.17%	11.45%	13.41%	1,109
Very good	36.25%	33.45%	37.69%	41.76%	40.34%	41.30%	4,374
Good	29.36%	28.57%	27.96%	26.56%	29.23%	25%	3,410
Fair	17.94%	22.06%	17.02%	13.74%	13.75%	17.39%	2,019
Poor	7.83%	6.33%	6.69%	6.78%	5.23%	2.9%	836
Education (%)							
No formal education	36.34%	40.25%	24.50%	14.75%	9.86%	7.12%	3,600

Primary education	40.9%	41.84%	44.96%	29.86%	26.81%	20.64%	4,524
Secondary education	21.58%	17.73%	28.53%	34.17%	48.97%	43.77%	3,287
Tertiary education	1.18%	0.18%	2.02%	21.22%	14.36%	28.47%	597
First job (%)							
Government	0.77%	0.39%	1.04%	11.02%	4.75%	8.57%	224
Institutions	1.64%	1.57%	2.08%	18.16%	15.40%	22.86%	561
NGO	0.2%	0.39%	0%	0.41%	0.66%	1.22%	34
State firms	1.46%	2.54%	3.12%	34.49%	41.72%	47.76%	1,174
Individual firms	1.45%	1.57%	5.56%	4.29%	4.14%	2.04%	234
Farmers	91.82%	89.43%	84.72%	25.71%	27.70%	10.61%	8,259
Individual household	0.37%	0%	0.69%	0.2%	0.55%	0%	41
Other occupations	2.29%	4.11%	2.78%	5.71%	5.08%	6.94%	338
Current job status (%)							
Agricultural work	70.94%	66.37%	27.00%	2.18%	8.30%	1.09%	6,428
Wage work	6.04%	7.12%	28.78%	20.18%	34.60%	18.61%	1,483
Retirement age and receive a public pension	4.55%	5.16%	6.23%	49.82%	26.50%	49.64%	1,361
Retirement age and receive no pension	11.70%	12.81%	20.18%	11.82%	12.50%	14.60%	1,449
Not working	6.77%	8.54%	17.80%	16.00%	18.10%	16.06%	1,154
Annualised expenditure on food	7.38	6.80	10.98	13.68	12.01	15.41	11,320
Annualised expenditure on other things	13.27	16.03	24.52	31.85	21.80	28.97	11,830
Continues							
Household durables wealth	6.47	4.61	10.74	14.74	11.46	22.74	12,014
House ownership (%)							
None	7.77%	10.55%	33.23%	12.99%	12.21%	16.73%	1,161
Partially	5.02%	3.22%	2.08%	3.15%	2.35%	6.69%	515
Fully	87.21%	86.23%	64.69%	83.86%	85.44%	76.58%	10,152
Years since migration	0.00	34.13	22.84	32.51	0.00	31.65	11,984
Social activity (%)							
None	55.14%	52.36%	57.29%	43.65%	43.24%	37.29%	5,593
One type	34.80%	37.20%	32.20%	33.61%	34.87%	35.59%	3,734
Two types	9.64%	9.84%	9.15%	16.60%	16.63%	17.80%	1,213
Three types	0.42%	0.59%	1.36%	6.15%	5.27%	9.32%	185
Familial support (%)							
Living with children	41.80%	43.06%	50.00%	40.52%	53.77%	37.34%	4,259
At least once every month	16.05%	13.18%	17.50%	28.20%	25.07%	30.47%	1,782
At least once every three months	14.27%	12.24%	7.86%	8.53%	7.55%	12.45%	1,213
At least once a year	21.34%	24.47%	18.93%	18.25%	10.58%	17.17%	1,868
Have children no support	4.67%	6.59%	4.64%	3.32%	1.66%	2.15%	398
No children and not living with children	1.85%	0.47%	1.07%	1.18%	1.37%	0.43%	157
Smoking history (%)							
Never	60.12%	77.09%	66.86%	65.46%	66.32%	72.36%	7,487
Current smoker	32.41%	17.58%	23.75%	20.25%	25.69%	18.55%	3,516
Former smoker	7.47%	5.33%	9.38%	14.29%	7.99%	9.09%	939
Drinking history							
Never	59.90%	71.40%	69.32%	64.67%	61.98%	61.68%	7,319
Current drinker	34.75%	25.75%	27.73%	27.54%	32.30%	32.85%	3,978
Former drinker	5.34%	2.84%	2.95%	7.79%	5.72%	5.47%	637
Sample sizes	8220	564	349	558	2052	285	

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From table 1, the means of health status and depression scores are lower for migrants compared with non-migrants, except for rural-to-rural migrants. Lower values of these variables indicate better health. For instance, the means of health status is 3.10 for rural non-migrants. This figure

for rural-to-urban migrants with a rural hukou is 2.88 and is 2.91 for rural to urban migrants with an urban hukou.

To show how different types of migration relate to health and mental health in later life, we look at the coefficients related to the different migration categories in table 2 and table 3, which all give difference in score compared with rural non-migrants. In both tables, after controlling for age and sex in specification one, compared with rural non-migrants, all of the groups except for rural-to-rural migrants, have better health status and depression scores. As explanatory factors are entered into the models they develop in different ways for each migrant category, so the following text discusses each of these categories in turn, in comparison with the rural non-migrant group.

Urban non-migrants have better self-assessed health and depression scores compared with rural non-migrants. For self-assessed health status, this advantage disappears when early-life factors are entered into the model (specification 2), suggesting that their relatively better self-accessed health can be explained by their early-life advantages. A similar pattern is present for depression scores. For instance, the coefficient in table 3 is reduced by almost two thirds from -2.395 ($p<0.001$) in specification one to -0.801 ($p<0.01$) in specification two.

Table 2 Self-reported health and Migration Status (Ordered logistic regressions)

Model specifications	1 + Age, sex	2 + early-life	3 + current socio-economic	4 + city adaptation	5 Full model	6 Full model (Parsimonious model)
Rural never mover	.	.	.	.	.	.
Rural to rural	1.017	1.041	1.032	0.895	0.862	1.018
	(0.119)	(0.122)	(0.123)	(0.185)	(0.178)	(0.123)
Rural to urban, with rural hukou	0.707	0.734	0.608*	0.552*	0.542*	0.595*
	(0.195)	(0.190)	(0.123)	(0.130)	(0.130)	(0.139)
Rural to urban, with urban hukou	0.632***	0.957	0.803	0.713	0.671	0.806
	(0.080)	(0.143)	(0.126)	(0.168)	(0.159)	(0.124)

Urban never mover	0.653***	0.930	0.815*	0.839	0.853	0.860
	(0.041)	(0.083)	(0.081)	(0.084)	(0.086)	(0.086)
Urban to urban	0.323***	0.529**	0.426***	0.391***	0.404***	0.480***
	(0.061)	(0.106)	(0.096)	(0.108)	(0.109)	(0.104)
Observations	7747	7747	7747	7747	7747	7747
Pseudo R^2	0.018	0.027	0.039	0.040	0.048	0.047

Exponentiated coefficients; Robust standard errors in parentheses * p < 0.05, ** p < 0.01, *** p < 0.001
Model 1 includes age and sex
Model 2 all factors in previous model + marital status, youth health, education and first job
Model 3 all factors in previous model + current job status, annualised food and other expenditure, household durables wealth and house ownership
Model 4 all factors in previous model + years since migration and participation in social activities
Model 5 all factors in previous model + familial support, smoking and drinking behaviours
Model 6 includes age, sex, youth health, education, first job, current job status, household durables wealth, participation in social activities, familial support, smoking and drinking behaviours.

Second, there is a consistent advantage in depression scores associated with the rural-to-urban migrants for those with a rural hukou when compared with rural non-migrants. This advantage slightly attenuates after adjusting for differences in selective and current socioeconomic factors, but then gets stronger after adjusting for disadvantages that are associated with their post-migration social connections. For example, in table 3 of depression scores, after controlling for pre-migration early-life factors in specification two, the size of the coefficient on this group attenuates from -1.397 ($p<0.05$) in specification one to -1.328 ($p<0.01$) in specification two. The coefficient becomes -1.297 ($p<0.01$) after additionally controlling for current socioeconomic factors. After controlling for factors related to city adaptation, this coefficient increases to -1.560 ($p<0.01$) in specification four. Then, this coefficient slightly attenuates to -1.463 ($p<0.01$) in the full model. In table 2 of self-assessed health status, there are no statistically significant differences between this group and rural non-migrants after adjusting for age and sex, controlling for pre-migration selective factors do not change this relationship. Nevertheless, this migrant group has better self-assessed health status after controlling for current socioeconomic disadvantages in specification 3 compared with rural non-migrants with an odds ratio of 0.608 ($p<0.05$). The size of the odds ratio then slightly decreases after adjusting for factors related to city adaptation. The odds ratio is 0.542 ($p<0.05$) after additionally adjusting for familial support and behaviour factors in the full model.

Table 3 Depressions scores and migration status (OLS)

Model specifications	1 + Age, sex	2 + early life	3 + current socio-economic	4 + city adaptation	5 Full model	6 Full model (Parsimonious model)
Rural never mover	.	.	.	.	.	
Rural to rural	0.437	0.605	0.521	0.155	0.021	0.477
	(0.392)	(0.389)	(0.389)	(0.590)	(0.589)	(0.389)
Rural to urban, with rural hukou	-1.397*	-1.328**	-1.297**	-1.560**	-1.463**	-1.415**
	(0.576)	(0.492)	(0.446)	(0.549)	(0.550)	(0.476)
Rural to urban, with urban hukou	-3.170***	-1.309**	-0.944	-1.249	-1.265	-0.870
	(0.590)	(0.498)	(0.503)	(0.659)	(0.661)	(0.496)
Urban never mover	-2.395***	-0.801**	-0.695*	-0.581*	-0.438	-0.466
	(0.192)	(0.253)	(0.273)	(0.271)	(0.270)	(0.270)
Urban to urban	-3.906***	-1.666**	-1.471**	-1.567*	-1.531*	-1.207*
	(0.458)	(0.545)	(0.567)	(0.662)	(0.666)	(0.545)
Observations	7684	7684	7684	7684	7684	7684
R2	0.0752	0.1165	0.1317	0.1392	0.1486	0.1476

Robust standard errors in parentheses * p<0.05 ** p<0.01 *** p<0.001

Model 1 includes age and sex

Model 2 all factors in previous model + marital status, youth health, education and first job

Model 3 all factors in previous model + current job status, annualised food and other expenditure, household durables wealth and house ownership

Model 4 all factors in previous model + years since migration and participation in social activities

Model 5 all factors in previous model + familial support, smoking and drinking behaviours

Model 6 includes age, sex, marital status, youth health, education, first job, current job status, annualised food expenditure, household durables wealth, participation in social activities, familial support and drinking behaviours.

Third, rural-to-urban migrants with an urban hukou have one of the largest advantages in general health status and depression scores among all the migrant groups after controlling for age and sex in specification one in both tables 2 and 3. This large health advantage disappears after adjusting for early-life selective factors. For instance, in table 2, after adjusting for the early-life factors in specification two, the odds ratio for this group becomes 0.957 ($p>0.05$), whereas it is 0.632 ($p<0.001$) in specification one. The advantage in depression scores are explained after controlling for early-life selective and current socioeconomic factors. After adjusting for the early-life selective factors, the size of the coefficient of this group reduces by almost 60% from -3.170 ($p<0.001$) in specification one to -1.309 ($p<0.01$) in specification two. This advantage in depression scores entirely disappears after adjusting for current socio-economic factors in model three, with a coefficient of -0.944 ($p>0.05$).

Fourth, a similar pattern is present for the urban-to-urban group. In other words, the large health advantages associated with urban-to-urban migrants are largely explained by early-life selective factors, although current socioeconomic and factors related to city adaptation also attenuate this relationship. In both table 2 and 3, after adjusting for early-life selective factors, the size of the coefficients on this group reduce by almost 50%. For instance, in table 3 for depression scores, this coefficient is -3.906 ($p<0.001$) after controlling for age and sex in specification 1, it becomes -1.666 ($p<0.01$) after controlling for early-life selective factors in specification 2. Furthermore, we have also compared this group with urban non-migrants as reference group; the results conform to the above argument. For instance, for depression scores, this coefficient for this group is -1.512 ($p<0.01$) after adjusting for age and sex in specification one, whereas it is -0.865 ($p>0.05$) after adjusting for early-life factors in specification two, and this coefficient remains statistically insignificant in later models.

Finally, in both table 2 and 3, after controlling for age and sex, there are no statistically significant differences in health status and depression scores between rural-to-rural migrants and rural non-migrants in all specifications. This shows that not all types of migration are associated with health and well-being in later life in China.

The above results are consistent after several robustness checks. The results of parsimonious models give similar conclusions. The results of using the knee height to replace recalled youth health largely conform to the above findings. These can be found in the supplementary material. In addition, for self-assessed general health, the results of multinomial logistic regressions and OLS regressions give similar results to the ordered logistic regression models presented here, these are available upon request.

Conclusion

Existing internal migration studies in China have primarily focused on those with a rural hukou moving from rural to urban areas, and within this have largely neglected the impacts of migration on health and well-being. In this paper, using the CHARLS dataset, we have examined how different types of internal migration relate to health and well-being in later life in China. The models presented in this paper allow for potential explanations for these associations with health and well-being to be tested. In our analyses, we have also controlled for selection features related to migration processes.

The findings suggest that there are strong associations between migration status and health and well-being in later life in China. Different types of internal migration are differentially associated with later-life health, with migrants to or within urban areas having the greatest health advantage relative to non-migrants in later life in China. Selection of migrants seem to be particularly important in explaining the health and mental health differences between non-migrants and migrants to or within the urban area as pre-migration early-life factors largely explained the differences in health and mental health between rural-to-urban migrants with an urban hukou and rural non-migrants. Moreover, different types of migration may be associated with different selection process. For instance, taking account of the early-life factors explained more than half the differences in depression scores between rural-to-urban migrants with an urban hukou and rural non-migrants, whereas these selective factors only explained about five percent of the differences in depression scores between rural-to-urban migrants with a rural hukou and rural non-migrants. Current socioeconomic factors also explain some health differences between migrant groups and non-migrants. Factors related to post-migration

adaptation are also important in terms of explaining differences in health and well-being between migrant groups and non-migrants. For instance, after adjusting for disadvantages in social connections, the size of the coefficients of the temporary rural-to-urban migration on self-assessed general health and depression scores gets stronger.

Furthermore, even after controlling for selective nature of migration and other post-migration factors, there is still an unexplained, positive and statistically significant migration effect on depression scores associated with rural-to-urban migrants with a rural hukou. This effect is also present for self-assessed health status after accounting for their disadvantaged current socioeconomic circumstances.

Additionally, it seems not all types of migration are associated with health and mental health effects, as there are no statistically significant differences in self-assessed health status and depression scores between rural-to-rural migrants and rural non-migrants across all models.

There are important limitations to this study. First, in this paper, we have focused on broad measures of health and wellbeing. Other health outcomes, such as conditions affected by environmental hazards in urban areas, might be negatively related to health and wellbeing of migrants at urban areas (Chen et al., 2013, Liu et al., 2017). Along with the dramatic migration to urban areas has happened in China, rapid urbanization has also taken place. Urbanization in China is associated with increasing consumption of processed and energy rich foods and a sedentary lifestyle, which can lead to various health problems such as diabetes and obesity (Yang et al., 2013, Gong et al., 2012). Using a nationally representative sample in China, Bi et

al (2016) find that overweight and obesity are more prevalent in male migrant workers than among men in the general population. Second, our results are likely to suffer from omitted variable bias due to the complex nature of different types of migration processes and the complex nature of health outcomes. For instance, a wide range of factors outside our models are likely to relate to health and well-being such as genetic diseases and community level factors. Third, although we have proxied for health before migration, our models are not immune from reverse causation, as factors in our model may not be causal antecedents. This may particularly be true with the current participation in social activities, as this may be a consequence of current health status. Fourth, we have excluded all return migrants. We may have misclassified some as we do not know if there is their last move and their motives for returning. This will reduce our power to detect our hypothesis as some migrants with positive associations will be misclassified as return migrants. Fifth, in this paper, we have been unable to deal with survival effects, where non-migrants in rural areas may have had lower survival rates, because they are less healthy, and thus our results of health status and depression scores proposed may be a conservative measure of the impact. These differential effects may happen as a result of existing inequalities between rural and urban areas in China.

The findings of this paper contribute to the existing literature by providing a framework to understand the impacts of migration on health and well-being in later life in China, as well as in the general migration context. This study of internal migration in China shows that the healthy migrant phenomenon is not entirely a story of selection, even though selection processes play a very important role in mechanisms through which migration affects health and well-being. There are other forces at play as well, for instance, current socioeconomic circumstances and post-migration adaptation seen in this study. In addition, this paper fills the

gaps in the literature of lack of understanding of wider forms of migration in China and their relationships with health and well-being in later life.

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